

What is claimed:

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At 5 1. A restraint system equipped with a shoulder holder to increase survival chance in an accident of a vehicle, train or an aeroplane or during turbulence-related vibrations of an aeroplane, comprising

10 a seat belt (1d, 1e) consisting of several belt shoulder portions;  
a shoulder holder (10d), having a pair of caps (10.2d); and  
a manually-operated rotatable device (28), having a pair of the rotatable levers (28.5), retained by the stop pieces (28.9) in the resting position, the ends of which is connected to the pair of caps (10.2d) and the other ends of which, connected to each other by a shaft (28.7), are rotatably attached to a pair of casings (29), each of which, defined by an L-shaped plate (28.4) and two outer tubes (28.1, 28.2), connected to each other by a coupling wall (28.3), is height adjustable, latchable and guided by the inner tubes (71, 72) of a seat backrest frame (3.4d);

wherein

15 the body of a passenger is restrained by the seat belt (1d, 1e) and in the operating position the shoulders are restrained by the caps (10.2d);  
where at least one belt shoulder portion of the seat belt (1d, 1e) is extended over at least one of the caps and over at least one of the U-shaped plates (10.15) thereof, when the rotatable levers (28.5) are manually rotated, causing the release cams (28.6) of the rotatable levers to force the rotation of the lock pawls (28.8), pre-loaded by the springs (28.10), thereby permitting the locking pins (28.12), pre-loaded by the springs (28.13), and loosely guided in the guide tubes (28.11), to move into the holes (28.14) of the casings (29) and block the rotatable levers in both directions.

25 2. A restraint system equipped with a shoulder holder to increase survival chance in an accident of a vehicle, train or an aeroplane or during turbulence-related vibrations of an aeroplane, comprising

30 a seat belt (1, 1e) consisting of several belt shoulder portions;  
a shoulder holder (10e), having a pair of caps (10.2e); and  
a motor-driven rotatable device (28a), having a pair of the rotatable levers (28.5a), the ends of which is connected to the pair of caps (10.2e) and the other ends of which, connected to each other by a shaft (28.7), are rotatably attached to a pair of casings (29a), each of which, defined by an L-shaped, partly laterally closed and partly laterally open plate (28.4a) and two outer tubes (41e, 41f), connected to each other by a coupling wall (28.3), is height adjustable, latchable and guided by the inner tubes (71, 72) of a seat backrest frame (3.4e); and

35 energy absorbers (40e, 40f), having a number of clamping elements (42e, 42f) provided with sites of predetermined fracture (s), biased, arranged along the outer tubes (41e, 41f) and tautly, less tautly and/or loosely connected to the pair of rotatable levers via the stop pieces (28.9a) by the corresponding wires (47e, 47f);

40 wherein

the body of a passenger is restrained by the seat belt (1, 1e) and in the operating position the shoulders are restrained by the caps (10.2e);

45 where at least one belt shoulder portion of the seat belt (1, 1e) is extended over at least one of the caps and over at least one of the U-shaped plates (10.15) thereof, when the rotatable levers (28.5a) are rotated by a drive apparatus (80), causing the release cams (28.6a) of the rotatable levers to force the rotation of the lock pawls (28.8a), pre-loaded by the springs (28.10a), thereby permitting the locking pins (28.12), pre-loaded by the

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5 springs (28.13), and loosely guided in the guide tubes (28.11), to move into the holes (28.14) of the casings (29a) and block the rotatable levers in one direction; where in the real accident the forward motion of the torso and head rotates the rotatable levers in the other direction through the openings of the plates (28.4a), thus moving the clamping elements (42e, 42f) along the corresponding tubes (41e, 41f) resulting in the work of deformation and friction, during which vibrations are damped and the stored energy is released by fracture of the sites of predetermined fracture of the clamping elements in excess of the respective threshold values.

10 3. A restraint system equipped with a shoulder holder to increase survival chance in an accident of a vehicle, train or an aeroplane or during turbulence-related vibrations of an aeroplane, comprising  
a seat belt (1, 1b, 1e) consisting of several belt portions;  
a shoulder holder (10, 10b, 10f), having a pair of caps (10.2, 10.2b, 10.2f) with open apertures to receive the belt portions in the operating position;  
15 a pair of latch plates (10.1b), connected to the caps (10.2, 10.2b, 10.2f), with open apertures, in which the belt portions are loosely secured by the quick-release pins (10.10) in the operating position and released by withdrawal thereof for removal in the resting position; and  
at least one pair of buckle assemblies (18a / 19a to 18n / 19n), attached in a seat backrest (3.2a, 3.2c);  
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wherein

the body of a passenger is restrained by the seat belt (1, 1b, 1e) and in the operating position the shoulders are restrained by the caps (10.2, 10.2b, 10.2f) upon plug-in connection of the latch plates (10.1b) with the buckle assemblies (18a / 19a to 18n / 19n); and  
25 at least one belt shoulder portion of the seat belt (1, 1b, 1e) is extended over at least one of the open apertures of the caps and loosely secured in at least one of the open apertures of the latch plates.

30 4. A restraint system equipped with a shoulder- and neck holder to increase survival chance in an accident of a vehicle, train or an aeroplane or during turbulence-related vibrations of an aeroplane, comprising

a seat belt (1a, 1c, 1e) consisting of several belt portions;  
a one-piece shoulder- and neck holder (10a, 10c), defined by a neck cap (10.4a, 10.4c) and a shoulder cap (10.2a, 10.2c) with open apertures to receive the belt portions in the operating position;

35 a pair of latch plates (10.1b), connected to the shoulder cap (10.2a, 10.2c), with open apertures, in which the belt portions are loosely secured by the quick-release pins (10.10) in the operating position and released by withdrawal thereof for removal in the resting position; and

at least one pair of buckle assemblies (18a / 19a to 18n / 19n), attached in a seat backrest (3.2a, 3.2c);  
40

wherein

the body of a passenger is restrained by the seat belt (1a, 1c, 1e) and in the operating position the pair of shoulders and the neck are restrained by the shoulder cap (10.2a, 10.2c) and neck cap (10.4a, 10.4c) upon plug-in connection of the latch plates (10.1b) with the buckle assemblies (18a / 19a to 18n / 19n); and  
45

at least one belt shoulder portion of the seat belt (1a, 1c, 1e) is extended over at least one of the open apertures of the shoulder cap and loosely secured in at least one of the open apertures of the latch plates.

5. A restraint system according to claim 2, wherein the cap (10.2e), recessed about a supporting tube (3.61) of a head rest (3.6), is reinforced by a reinforcing plate (10.13).

6. A restraint system equipped with a shoulder- and neck holder according to claim 2, comprising a neck holder, having a pair of caps (10.4, 10.4b), rigidly attached to the pair of shoulder caps (10.2e), to restrain the neck in the operating position.

7. A restraint system according to claim 6 wherein the drive apparatus (80) is activated by a separately operated switch.

8. A restraint system according to claim 6, wherein the drive apparatus is activated by a controller, monitoring the speed, in excess of threshold speed.

9. A restraint system according to claim 6, wherein the drive apparatus is activated by an accelerator pedal.

10. A restraint system according to claim 6, wherein the drive apparatus is activated when a sensor senses an accident of a vehicle, train or an aeroplane or turbulence-related vibrations of an aeroplane.

11. A restraint system according to claim 6, wherein upon the pressure on a release button (87a to 87c) of the seat the drive apparatus (80) moves the shoulder- and neck holder back from the operating position to the resting position.

12. A restraint system according to claim 6, wherein upon the pressure on a master release button (84) of the lap buckle assembly (9.1) all latch plates of the seat belt are disengaged from the buckle assemblies and the drive apparatus (80) moves the shoulder- and neck holder back from the operating position to the resting position.

13. A restraint system equipped with a shoulder- and neck holder according to claim 3, comprising a neck holder, having a pair of caps (10.4, 10.4b), insertably attached to the pair of shoulder caps (10.2, 10.2b, 10.2f), to restrain the neck in the operating position, and detachable therefrom for removal.

14. A restraint system according to claim 13, wherein the shoulder- and neck holder (10, 10b, 10f) is provided with at least one energy absorber (10.3, 10.3a, 10.5, 10.5a, 10.5c).

15. A restraint system according to claim 14, wherein the energy absorber is fastened to the cap by an adhesive fastener and detachable therefrom by opening the fastener.

16. A restraint system according to claim 3, wherein the shoulder cap is shoulder-shaped.

17. A restraint system according to claim 14, wherein the energy absorber is shoulder-shaped.

18. A restraint system according to claim 13, wherein the neck cap is neck-shaped.

19. A restraint system according to claim 14, wherein the energy absorber is neck-shaped.

20. A restraint system according to claim 19, wherein the energy absorber (10.5a), arranged in the neck cap (10.4a), serves as a neck collar having a wide portion for the chin.

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21. A restraint system according to claim 3, wherein the latch plate is provided with an energy absorber (10.9).

22. A restraint system according to claim 13, wherein the shoulder- and neck cap is adjustable in height by rotating a bolt (10.7) in a threaded hole of a flange (10.12).

5 23. A restraint system according to claim 13, wherein the shoulder- and neck cap is adjustable in width by rotating a bolt (10.6a) in a threaded hole of a flange (10.12f).

24. A restraint system equipped with a shoulder- and neck holder and energy absorbers to absorb great energy and damp strong vibration according to claim 13, further comprising at least one energy absorber (30, 40, 50), which consists of

10 a retaining element (31, 41, 51), fastened to a seat frame, generally representing a seat-cushion- or seat backrest frame, and  
at least one clamping element (32, 32.1 to 32.n, 42, 42.1 to 42.n, 52, 52.1 to 52.n),  
connected to the buckle assembly of the seat by means of at least one wire (37, 47, 57),  
15 biased, arranged along the retaining element and provided with sites of predetermined fracture (s), which have at least one threshold value.

25. A restraint system according to claim 24, wherein the retaining element is integral part of the seat backrest frame.

26. A restraint system according to claim 24, wherein the clamping element has open and tube-shaped profile.

20 27. A restraint system according to claim 24, wherein the retaining element is tube-shaped.

28. A restraint system according to claim 24, wherein a longitudinal rib (41.1, 51.1) is arranged to the retaining element.

29. A restraint system according to claim 28, wherein both edges of the clamping element are loosely guided by the longitudinal rib in longitudinal direction.

25 30. A restraint system according to claim 28, wherein a stop element (41.3) is arranged to the longitudinal rib.

31. A restraint system according to claim 28, wherein the thickness of the longitudinal rib increases in longitudinal direction of the movement of the clamping element.

32. A restraint system according to claim 24, wherein the clamping element is cone-shaped.

30 33. A restraint system according to claim 24, wherein the retaining element (51) is cone-shaped.

34. A restraint system according to claim 24, wherein at least one stop pin (46, 46.1 to 46.n) is laterally arranged to the retaining element, where the pin blocks the movement of the clamping element, thus resulting in fracture of the sites of predetermined fracture.

35 35. A restraint system according to claim 24, wherein the contact surfaces of the retaining element have arbitrary friction coefficients ( $\mu_0$ ).

36. A restraint system according to claim 24, wherein the contact surfaces of the retaining element are provided with a soundproofing material (83).

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37. A restraint system according to claim 24, wherein the contact surfaces of the clamping element have arbitrary friction coefficients ( $\mu_0$ ).

38. A restraint system according to claim 24, wherein the contact surfaces of the clamping element are provided with a soundproofing material (83).

5 39. A restraint system according to claim 29, wherein the end portions of a complementary wires (37a1), connected to a control-wire (37), are inserted into both cylinder-shaped edges (37c1) of the clamping elements (32) and secured by clamping the edges (37c1).

40. A restraint system according to claim 24, wherein the clamping element is provided with a pair of ribs, whereto several pairs of adjusting holes ( $L_1$  to  $L_c$ ) are arranged.

10 41. A restraint system according to claim 24, wherein a set of energy absorbers comprises the retaining element, at least one stop pin, at least one stop element, one control-clamping element, connected to a control-wire, and complementary clamping elements with/without sites of predetermined fracture, where all clamping elements, arranged along the retaining element, are tautly, less tautly and/or loosely connected to each other by means of  
15 complementary wires.

42. A restraint system according to claim 41, wherein an energy-absorbing device comprises a couple member (1.2a, 1.2b) and sets of energy absorbers, the control-wires of which are tautly, less tautly and/or loosely connected to the couple member.

20 43. A restraint system according to claim 42, wherein a guide piece (4.7a), fastened to the seat frame, has  
a pair of engaging parts (4.10a), form-locking connected to the corresponding apertures of a housing (4.8a) of the buckle assembly; and  
a recess (4.5a) to loosely guide a tie band (1.1a), one end of which is connected to the buckle assembly and the other end to the couple member.

25 44. A restraint system according to claim 42, wherein a guide piece (4.7b), fastened to the seat frame, has  
a pair of engaging parts (4.10b), form-locking connected to the corresponding apertures of a housing (4.8b) of the buckle assembly; and  
a longitudinal groove (4.5b) to loosely guide a tie band (1.1b), one end of which is  
30 connected to the buckle assembly and the other end to the couple member.

45. A restraint system according to claim 42, wherein a housing (4.8c), movable along a pair of tubes (27.3) of the seat backrest frame and latchable thereon, has  
an aperture to receive an engaging part (4.10c) of the buckle assembly, through a hole (2.3)  
of which a wire is protruded and both end portions of the wire, serving as tie bands, are  
35 secured by a bracket (1.7); and  
two holes (4.5c) to loosely guide the tie bands, connected to the couple members.

46. A restraint system according to claim 42, wherein at least one latch plate (11, 25), slideable along the lap belt portion, is in plug-in connected to the buckle assembly (7, 8), equipped with the energy-absorbing device, of the seat cushion, to restrain both thighs of the  
40 passenger and absorb energy and damp vibrations in the event of submarining, rollover or turbulence-related vibrations.

47. A restraint system according to claim 13, wherein upon the pressure on a master release button (84) of the lap buckle assembly (9.1) all latch plates of the seat belt and holder are disengaged.

48. A restraint system according to claim 3, wherein the shoulder holder is fastened to the seat for the purpose of storage and detachable therefrom upon the pressure on a release button (87a to 87c) of the seat.

49. A restraint system according to claim 13, wherein the shoulder- and neck holder is fastened to the seat for the purpose of storage and detachable therefrom upon the pressure on a release button of the seat.

50. A restraint system according to claim 49, wherein a detachable front portion of the seat cushion (3.1a) serves as a shoulder- and neck holder (10a), the latch plates of which are plugged in connected to the seat backrest, to restrain the shoulders and neck of a belted child and the space thereof is exploited to accommodate the legs of the child sitting on the rear portion thereof, thus integrating the seat belt, holder and seat into an energy-absorbing child-seat.

51. A restraint system according to claim 50, wherein the child-seat is transformed into a baby-cot when the seat backrest is flipped into a resting position.

52. A restraint system, characterized by use of metal, compound material, glass fibre reinforced material or non-metal material for material of the parts of the shoulder- restraint system, neck holder and set of energy absorbers.

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